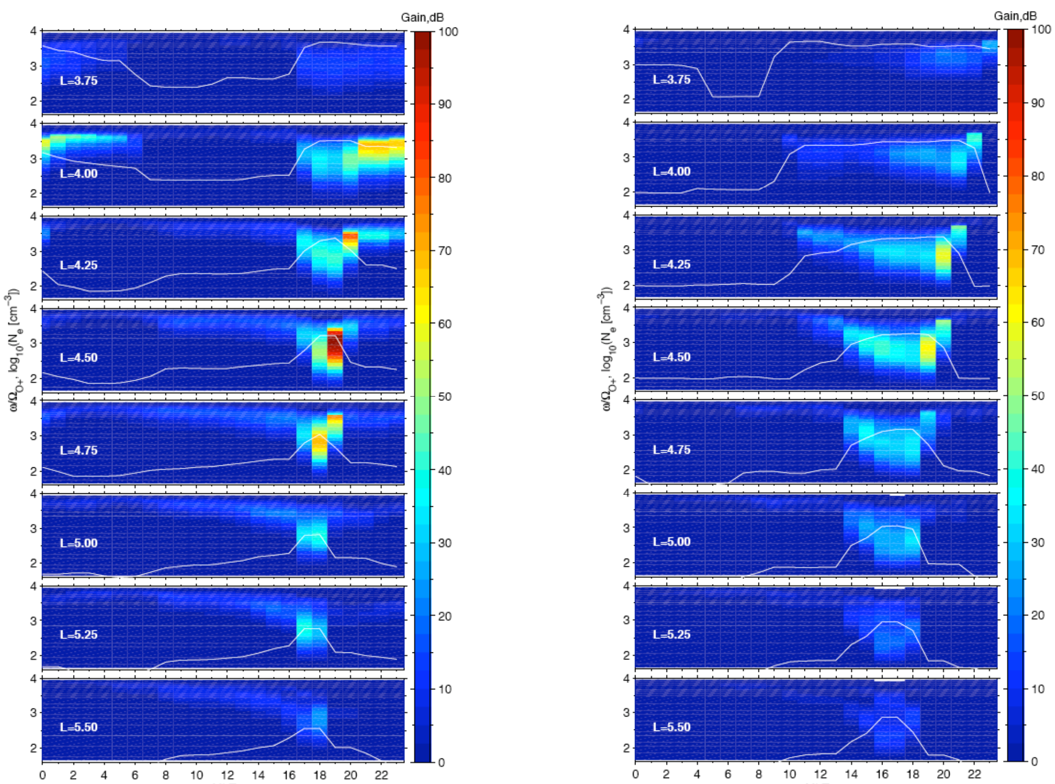
Ring Current Evolution During Magnetic Storms and Associated Plasma Wave Excitation.

R. M. Thorne, UCLA and V.K. Jordanova LANL

Under our collaborative NASA Heliospheric Physics Theory research grants, the dynamical evolution of the ring current has been simulated during a magnetic storm by coupling the Rice Convection Model with the Ring current and Atmospheric interactions (RAM) Model. Simulated phase space densities of injected electrons and ions from RAM have been used to evaluate the global excitation of two important plasma waves, chorus emissions and electromagnetic ion cyclotron waves which play a dominant role in the acceleration and loss of energetic radiation belt electrons. The path integrated gain of EMIC waves, in the frequency range between the O^+ and He^+ ion gyrofrequencies is indicated below for conditions in the main phase (left) and early recovery phase (right) of a storm. The plasma density is superimposed as solid white lines. Ring current H+ injected from the plasma sheet provides the source of free energy for EMIC excitation during the storm. Significant wave gain is confined to a limited spatial region at the eastward edge of the plume near dusk and along the pre-midnight plasmapause. Waves just below He+ gyro-frequency (>3.7 Ω_{O+}) are suppressed for all locations and all times as a result of He+ cyclotron absorption and propagation effects. The excited waves (> 30 dB) are able to resonate and scatter relativistic electrons, but the minimum electron resonant energy is generally above 3 MeV.



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